Kinetic Response

Short Term Relief, Long Term Recovery

Victory Baptist Temple
Emergency Housing

Relief Site One

First Baptist Church
Emergency Housing

Relief Site Two

460’

580’

498’

Piedmont, MO

0’ 500’ 1000’ 2000’

N

Site One
Scale 1”=80’

Cleanse

Community Gathering

Cleanse

McKenzie Creek

Relief Site Two
516’

540’

503’

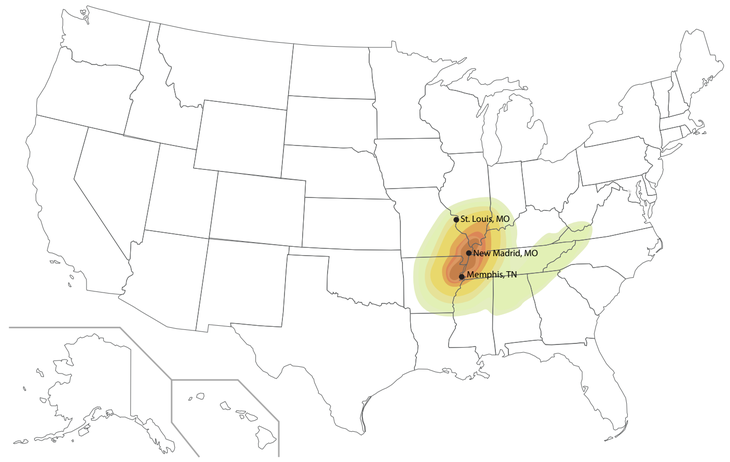
Problem Statement:

How can a structure act as the framework from relief to restoration of the built environment after a disaster while breathing new life into a damaged population?

Introduction of Universal to Specific Approach

Kinetic Response studies adaptable design to investigate a universal to specific recovery process following that of relief, recovery and rebuilding in post-disaster scenarios. The shelter shall serve initially for universal rapid deployment that will carry through as a framework for recovery. As the recovery phase moves forward the universal user (victim of hazard event) begins to invest into a permanent home. Through tectonic transitions, permanent living structures will emerge from a modular progression of space. Due to severe dynamic pressures of poverty and unemployment combined with the potential for an earthquake, Piedmont, Missouri will be the test scenario site for global poverty and vulnerability to disasters during relief and response phases and serve as a cultural specific location for permanent rebuilding.

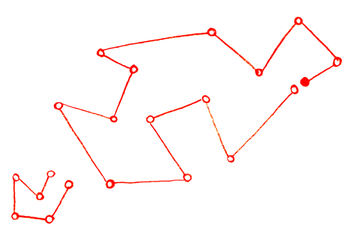
New Madrid Seismic Zone

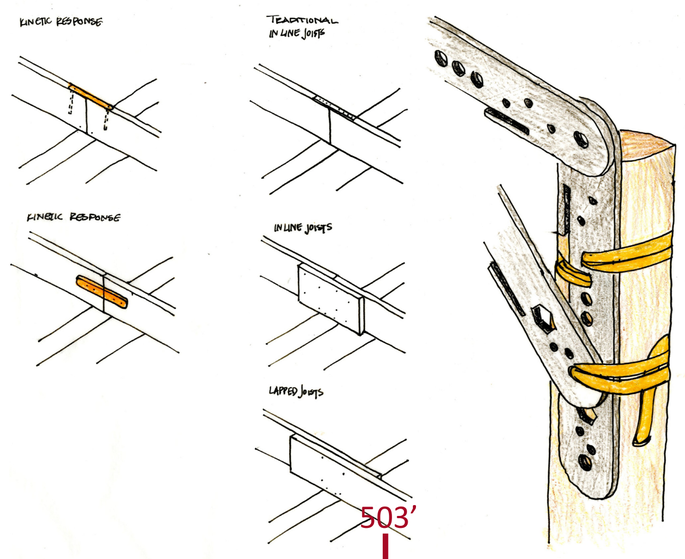


Lurking beneath Piedmont and the surrounding Ozarks lies the New Madrid Fault Line stretching from St. Louis, MO to Memphis, TN. Two-thousand and eleven marks the Bicentennial of a series of 7.0+ earthquakes during 1811-1812 along the New Madrid Fault Line. Recently in 2008, a 5.2M earthquake struck Missouri and a 4.7M earthquake struck Arkansas on February 27, 2011. Due to heightened concern for the region, in May FEMA will conduct the National Level Exercise of an earthquake scenario in the NMSZ. The exercise will include 8 states covering 4 FEMA regions. It is due to this potential earthquake in the NMSZ that Piedmont was selected as a site. Actions and events for Kinetic Response reflect the expected time line proposed for the National Level Exercise 2011.

Process

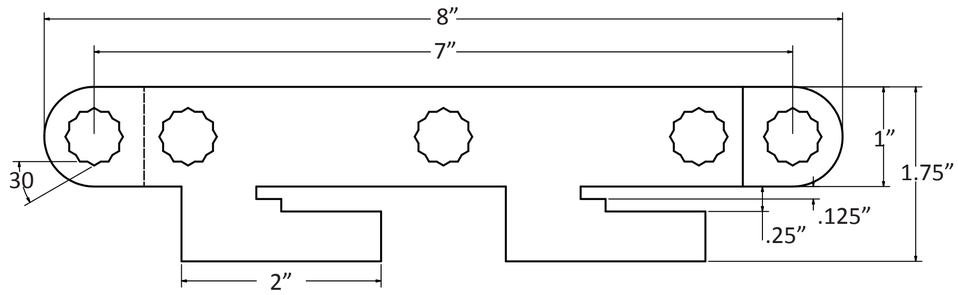
Kinetic Response is focused on the development of tectonics for multiple uses during and after a disaster strike. These studies of form and function were explored and tested against existing details and developed through one-one scale modeling.

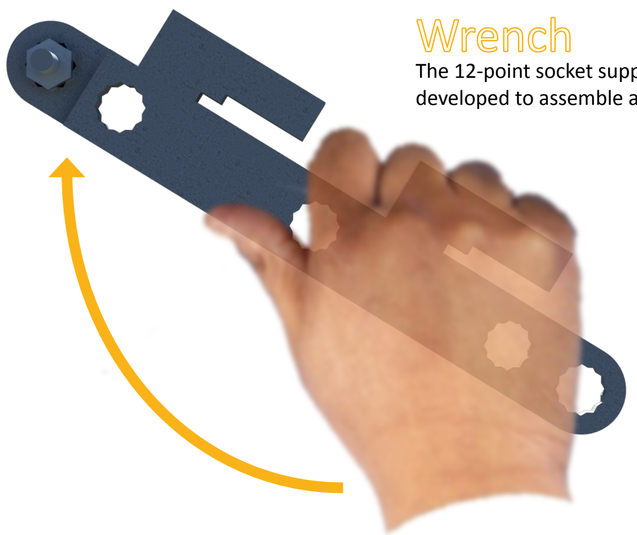




Kinetic Tectonic #1:

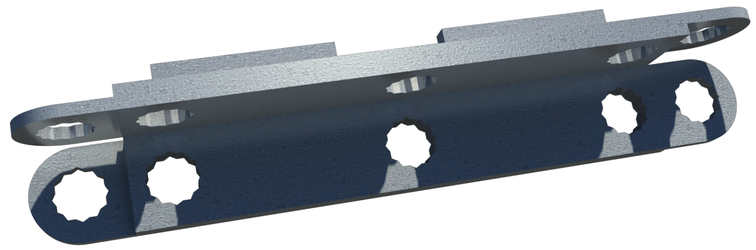
Kinetic Tectonic #1 is an innovative approach to allowing one simple component translate to multiple uses through all stages of emergency management. The design allows numerous functions ranging from assembly of the emergency shelter to post-disaster uses as hurricane ties.





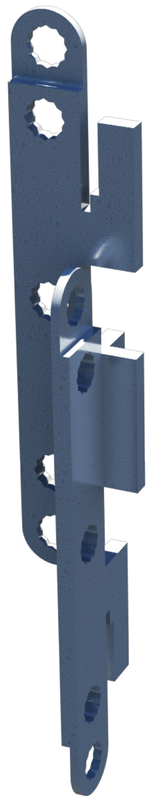
Wrench

The 12-point socket supports a 1/4:20 common hex bolt. This configuration was developed to assemble and disassemble Kinetic Response.



L-Angle

When assembled as an L-angle, the Kinetic Tectonic can be used in typical construction applications. Most commonly the L-angle will function as a support for horizontal braces.

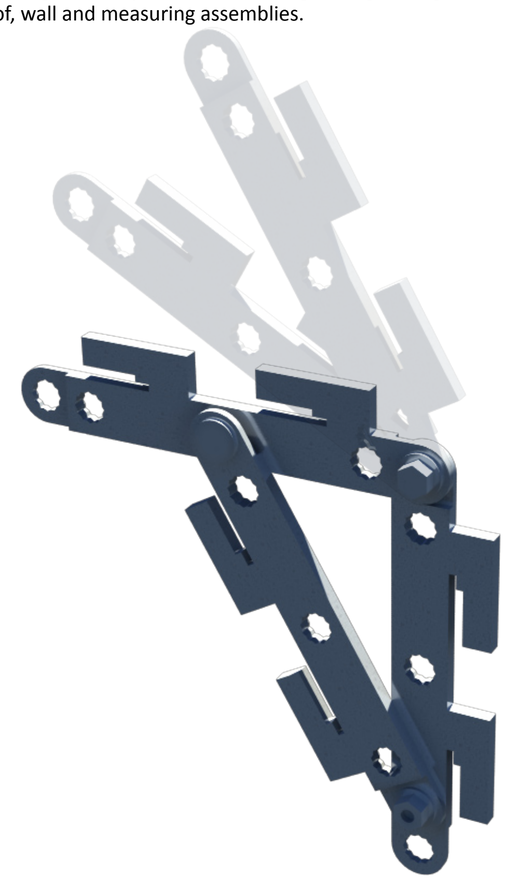


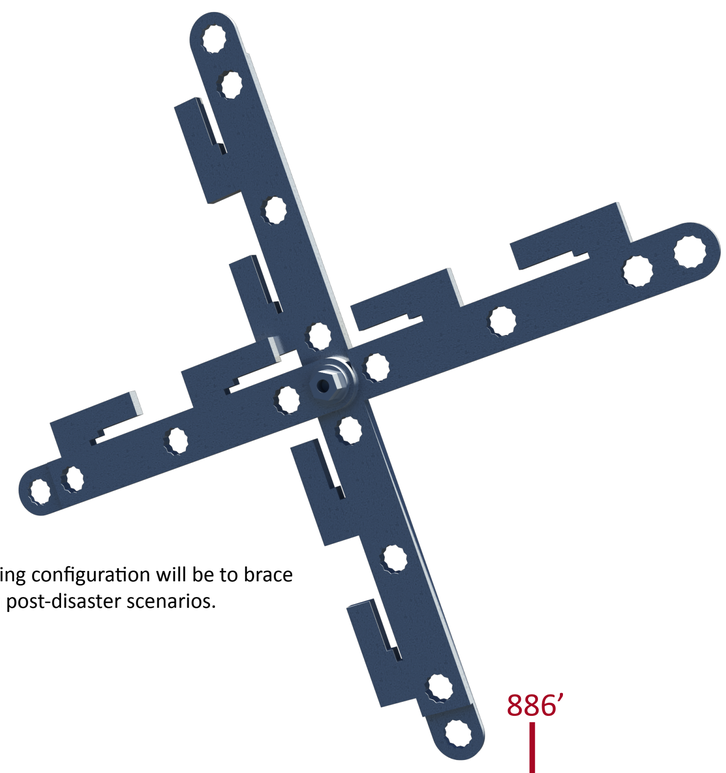
Hurricane Tie

In many post-disaster sites hit by hurricanes, codes have changed and require the use of hurricane ties to secure the structure from wind uplift. Through slotted joints, Kinetic Tectonic #1 can be used in the recovery phase to better mitigate future disasters.

30-60-90 Triangle

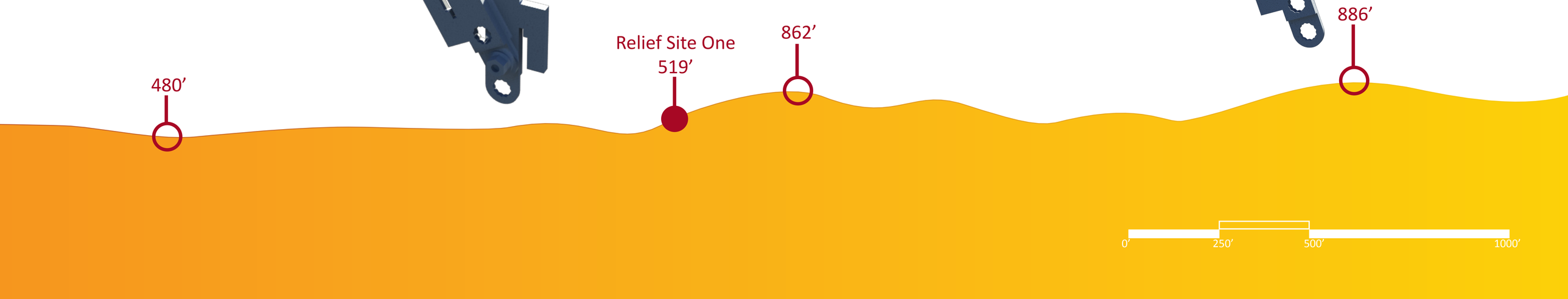
The Kinetic Tectonic #1 was founded on a system that allows the user to adjust and lock at increments. Through the 12-point socket locking 30 degree angles can be achieved in use for roof, wall and measuring assemblies.



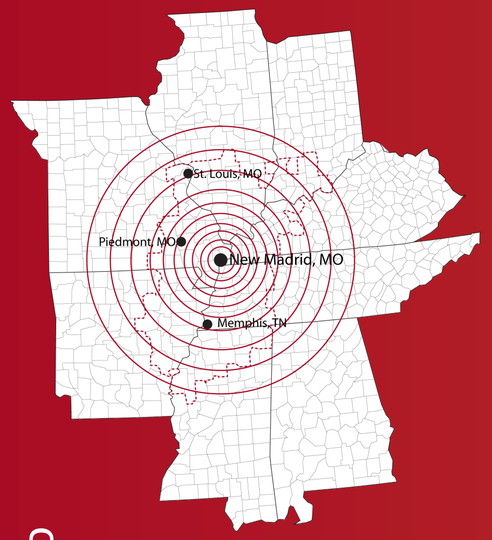


X-Bracing

The main function of the X-bracing configuration will be to brace and support damaged homes in post-disaster scenarios.



Disaster Scenario



May 16, 2011, 2:00am CST
7.7 Magnitude Earthquake
Epicenter: New Madrid, MO

713,000 buildings are completely damaged within 8 states. Over 210,000 of these are single family residential.

2.6 million households are without power and 1.1 million households are without water

Casualties: 86,000 people are injured, 3,500 people have died, 686 deaths in Missouri.

2:00am CST
Individuals find safety and first responders arrive at the scene.

Wayne County Emergency Management is dispatched and the City of Piedmont Emergency Management is enabled.

1-3 Hours: 5:00am CST
EOC is enabled by the City of Piedmont

Damaged infrastructure makes communication and transportation difficult. HWY 34, 49, and Hh are severely damaged.

An emergency official makes contact with the media. The public and media broadcast the earthquake throughout the world.

A temporary morgue has been established.

3-12 Hours: 2:00pm CST
Search and Rescue continues while medical operations are set up in the Wayne County Medical Center and Piedmont Family Clinic. Local Red Cross volunteers arrive. **Two relief sites are designated.**

A temporary footbridge has been set up to cross McKenzie Creek to access Medical Clinics.

12-24 Hours: 2:00am CST
S&R resides and National Guard arrives.
Overnight accommodations are set up at Victory Baptist Temple and First Baptist Church adjacent to designated Relief Sites.

Volunteers and churches across the nation begin sending personal and goods to the NMSZ

May 17, 2011: Day 2
Shelter seeking victims remain housed in Victory Baptist Temple and First Baptist Church until Kinetic Response arrives.

Search and Excavation operations have ceased. Medical continues 24 hours a day to meet victims needs.

National Guard delivers portable toilets anticipating Kinetic Response arrival.

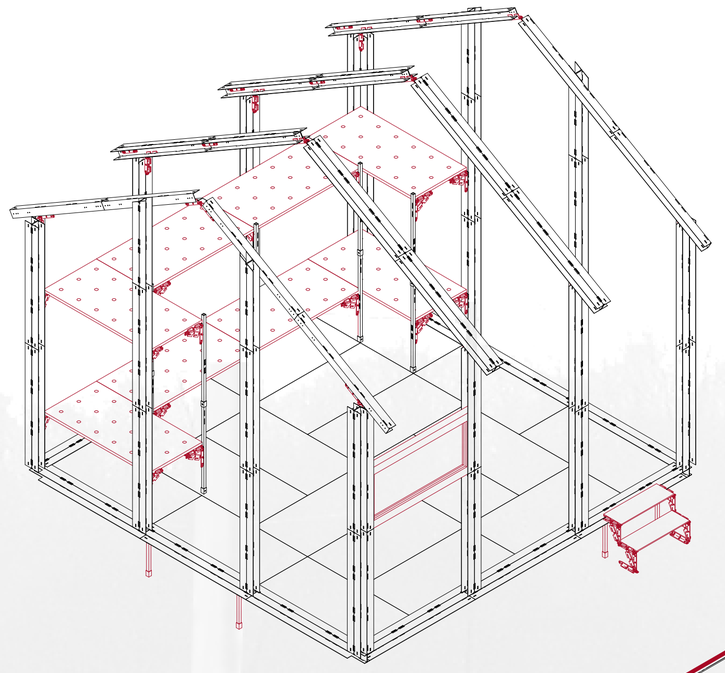
Active Water Systems arrive with waste water treatment containers.

May 18, 2011: Day 3
Piedmont's internal water supply is depleted. With reduced commodities and still no power, at-risk population and shelter seeking victims are 9 times higher than Day 1.

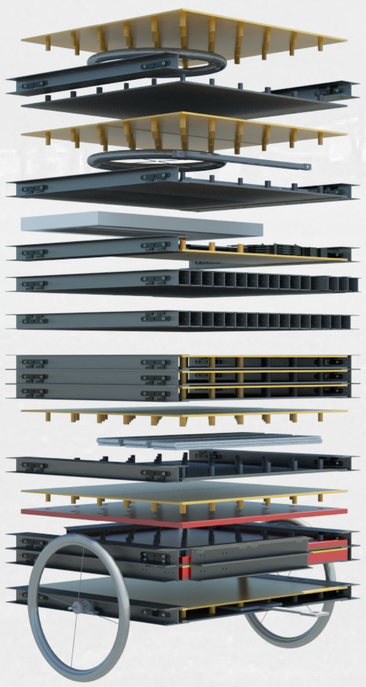
Three days after the earthquake, 7.2 million people are still displaced and 2 million people seek temporary shelter.

10:00am CST
FEMA officials arrive and Piedmont has been declared as a Disaster Site by the President.

3:00pm CST
Supply of Water, Ice, MREs and **Kinetic Response Emergency Shelters arrive.** 25,000 liters of water and **Kinetic Response** "pallets" arrive at the Piedmont Municipal Airport.



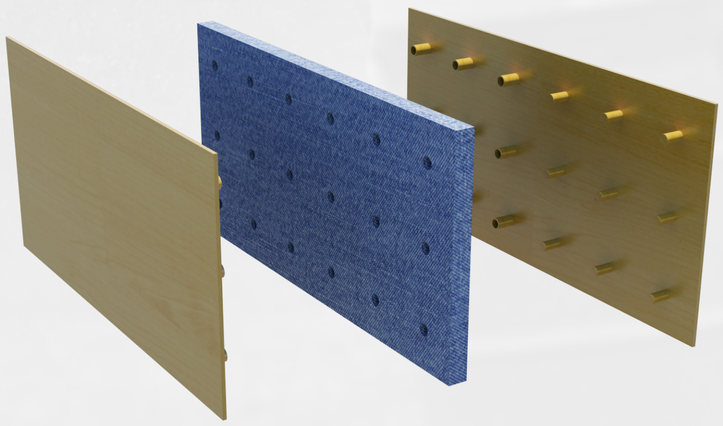
4 Emergency Shelter Immediate



Kinetic Response Emergency Kit:

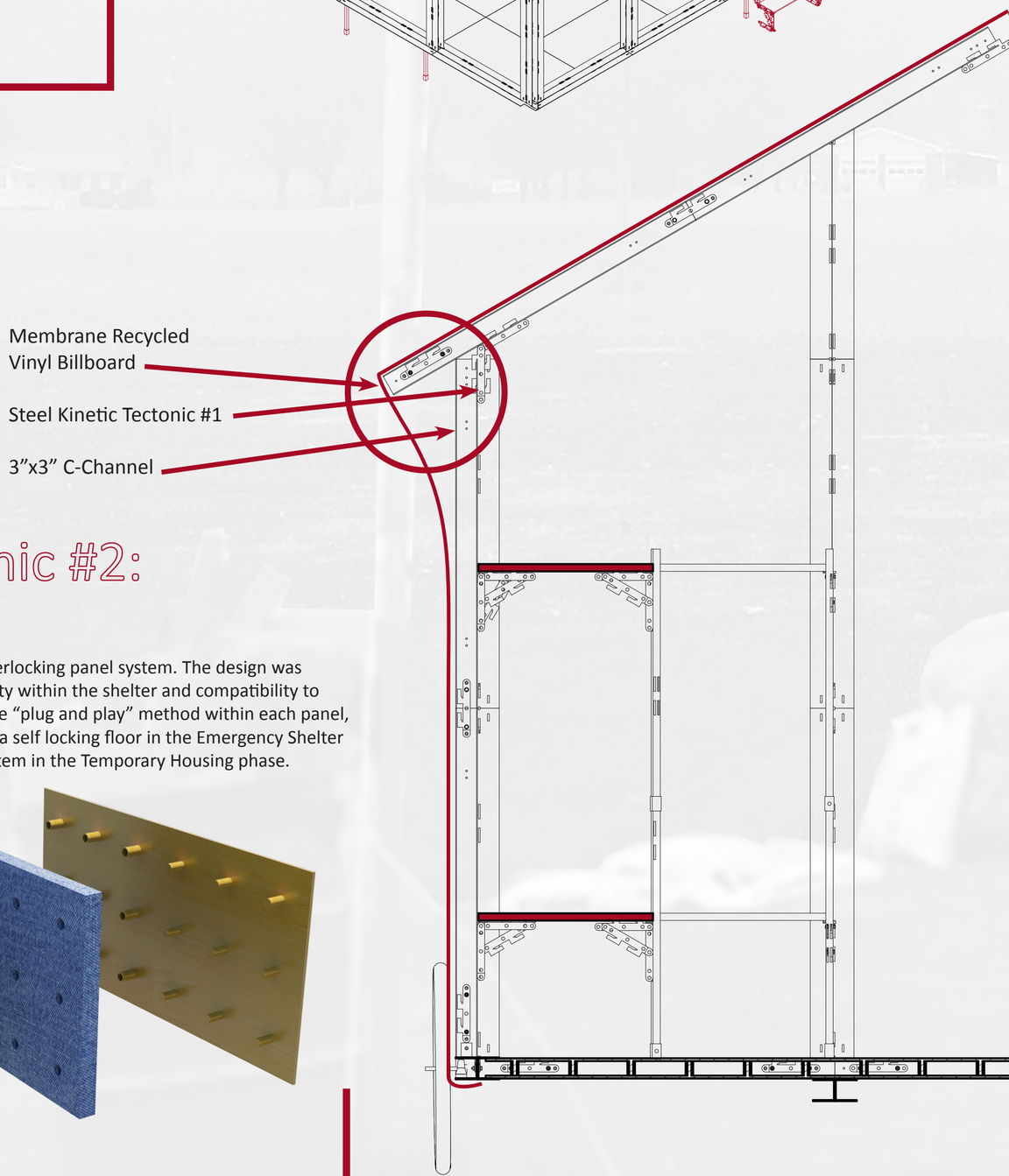
With versatility, the kit can be shipped in multiple forms. A cart was designed to allow pedestrian, livestock, or small engine travel with little to no use of power and major roadways. In the case of Piedmont, the shelter arrives via semi-truck. Each pre-packaged kit includes the following for the Emergency Shelter:

63: Kinetic Tectonic #1
40: 3"x3" Aluminum C-Channel
17: 3"x3" Angled Aluminum C-Channel
18: 2'x4' Kinetic Tectonic Panels
9: 4'x4' Kinetic Tectonic Panels
8: 2'x4' Perforated Panel for Bed
8: 1"x1" Aluminum Square Tubing
2: Tires
2: Mounted Ball Bearings
1: Polycarbonate Window
1: Recycled Vinyl Billboard



Kinetic Tectonic #2: Panel System

Kinetic Response is based on a 2'x4' interlocking panel system. The design was engineered to provide utmost modularity within the shelter and compatibility to existing 4'x8' sheathing. By mirroring the "plug and play" method within each panel, a standard 2'x4' panel can easily create a self locking floor in the Emergency Shelter phase and then be applied as a wall system in the Temporary Housing phase.



4:00pm CST
Kinetic Response Shelters arrive at Relief Sites transported by semi-truck. 292 Shelters are needed

7:00pm CST
The first Kinetic Response Emergency Shelter has been erected in just over 3 hours.

In Piedmont each family of 4 is allocated 432 S.F. (144 S.F. Emergency, Expected 144 S.F. for Temporary and 144 S.F. for vehicle/belongings)

May 19, 2011: Day 4
The last remaining shelters are assembled.

Site One: 184 Shelters
Site Two: 108 Shelters

Community Gathering spaces are formed. Cleanse and bathing locations are located on either end of the sites.

May 20, 2011: Day 5
Power is restored to Piedmont allowing critical businesses to open their doors. Hwy 34, 49, Hh are now open to public traffic.

Water Sanitation remains an issue.

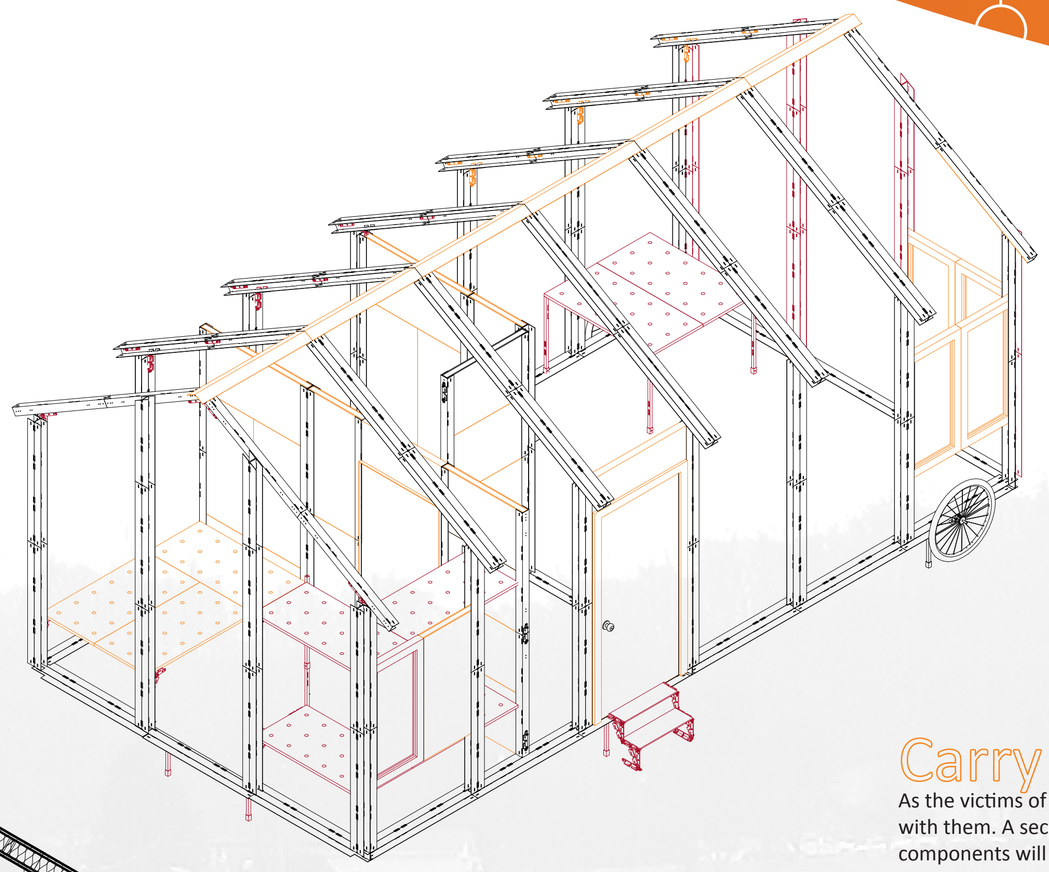
Major debris removal operations have begun on private property. It will take months to years to clean up damaged buildings.

May 21, 2011: Day 6
A second shipment of Kinetic Response kits arrive ready to transform the emergency shelters into temporary living conditions.

May 22, 2011: Day 7
Most remain housed and in need of assistance. 12'x12' Kinetic Response is added onto existing emergency shelters.

Within 1 day all of the temporary houses have been erected on both sites.

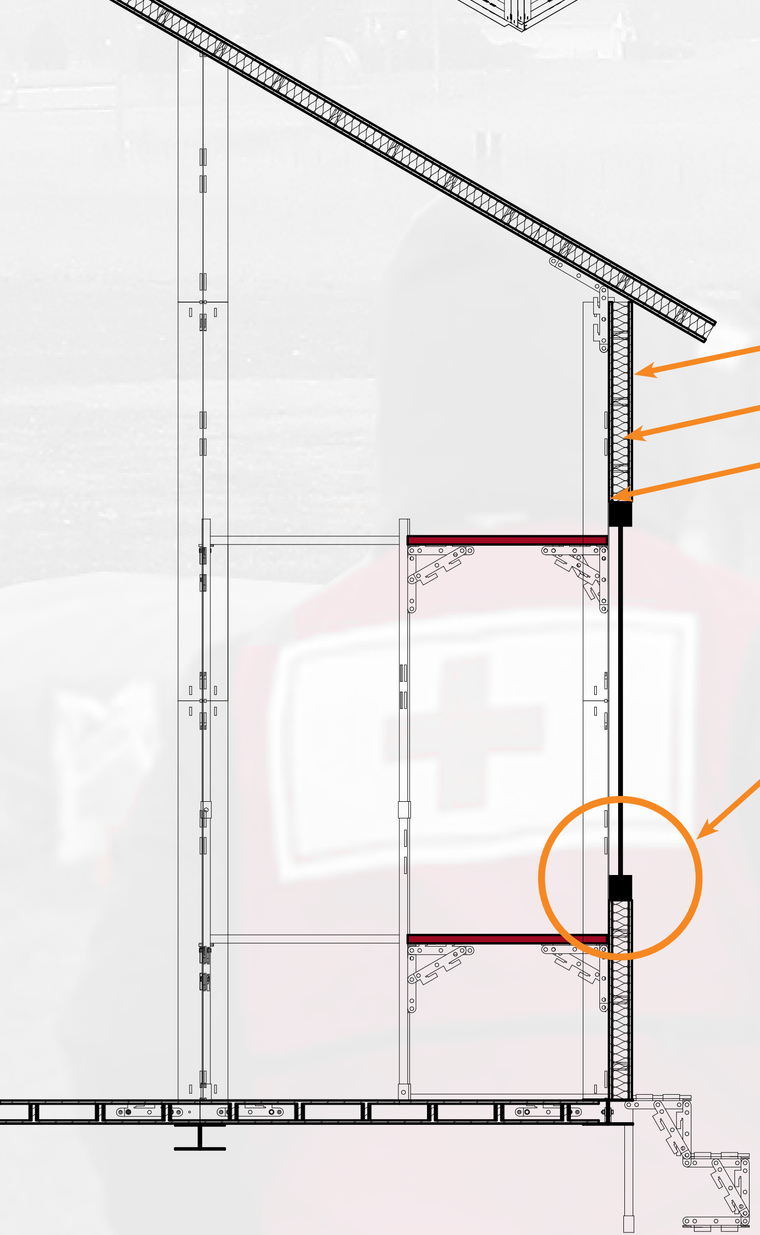
A shipment of Kinetic Tectonic #1 arrives for rebuilding semi-damaged structures.



Temporary Housing
1-6 months

Carry Through Tectonics Scale 1/2"=1'

As the victims of the disaster progress in their healing process the structure begins to transition with them. A second shipment of panel systems arrive allowing the shelter to morph. All existing components will remain with the structure and in current uses or move to a new desired location.



Section: 1"=1'

Window/Wall Panel Assembly:

The 2'x4' panel assembly allows maximum flexibility in window and wall design. An awning window provides the window to be oriented either vertically or horizontally within the wall channel assembly.

Kinetic Response is on the move. Three Temporary Housing units are the first to move to a permanent site.

These first permanent structures were simply added onto with one additional Kinetic Response Kit.

Temporary Kinetic Response houses continue to move to permanent locations. Some serve as a main house while others are bought from the government for use as a shed.

June 2011
Outside resources and personal begin to leave Piedmont and return home.

August 2011
Miscellaneous Kinetic Response tectonics are used to rebuild damaged houses. X-bracing has become the common use within the Ozark Region to mitigate another earthquake.

September, 2011
The first Kinetic Response swing set is installed at Rotary Park.

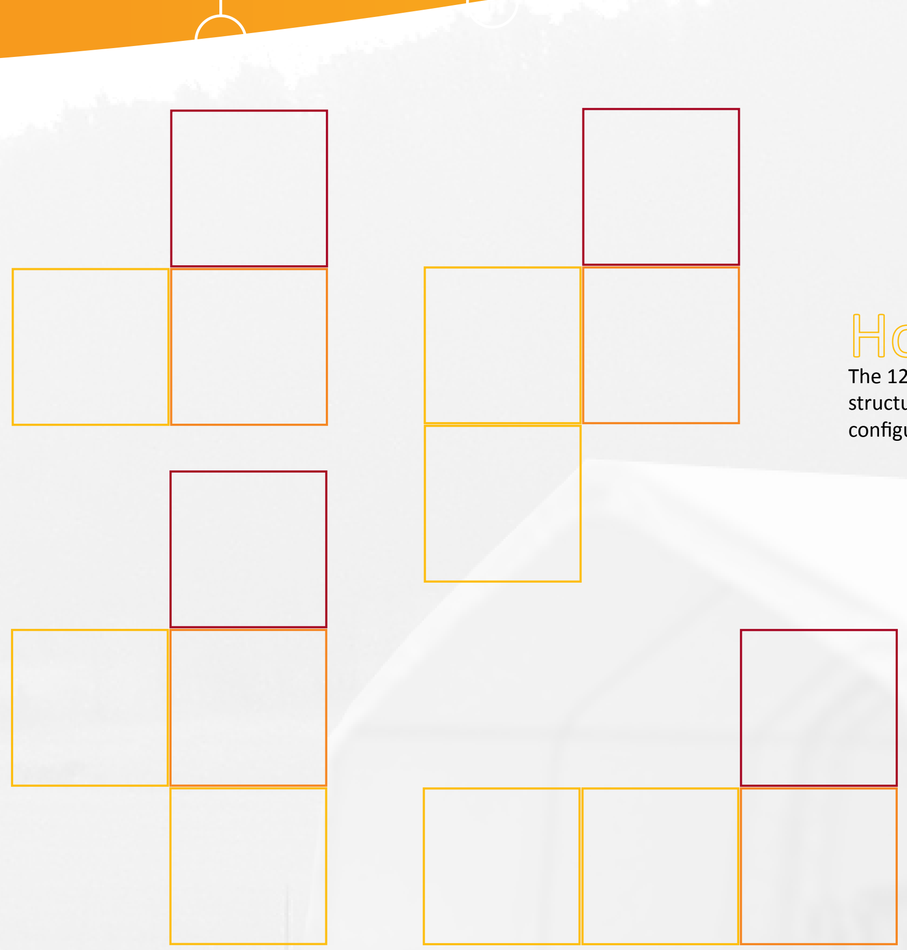
November 2011:
Within 6 months all Temporary Housing has moved off of relief sites to either designated new developments or home owner's property.

April 2012:
Reused Kinetic Response Emergency Shelters are retrofitted as greenhouses and sheds. Piedmont High School students build and sell the structures to raise money for the school.

Money raised from the school is given to help fund preparation for spring flooding of McKenzie Creek.

The first house based on 4 Kinetic Response kits is built. The structure is a 576 S.F.

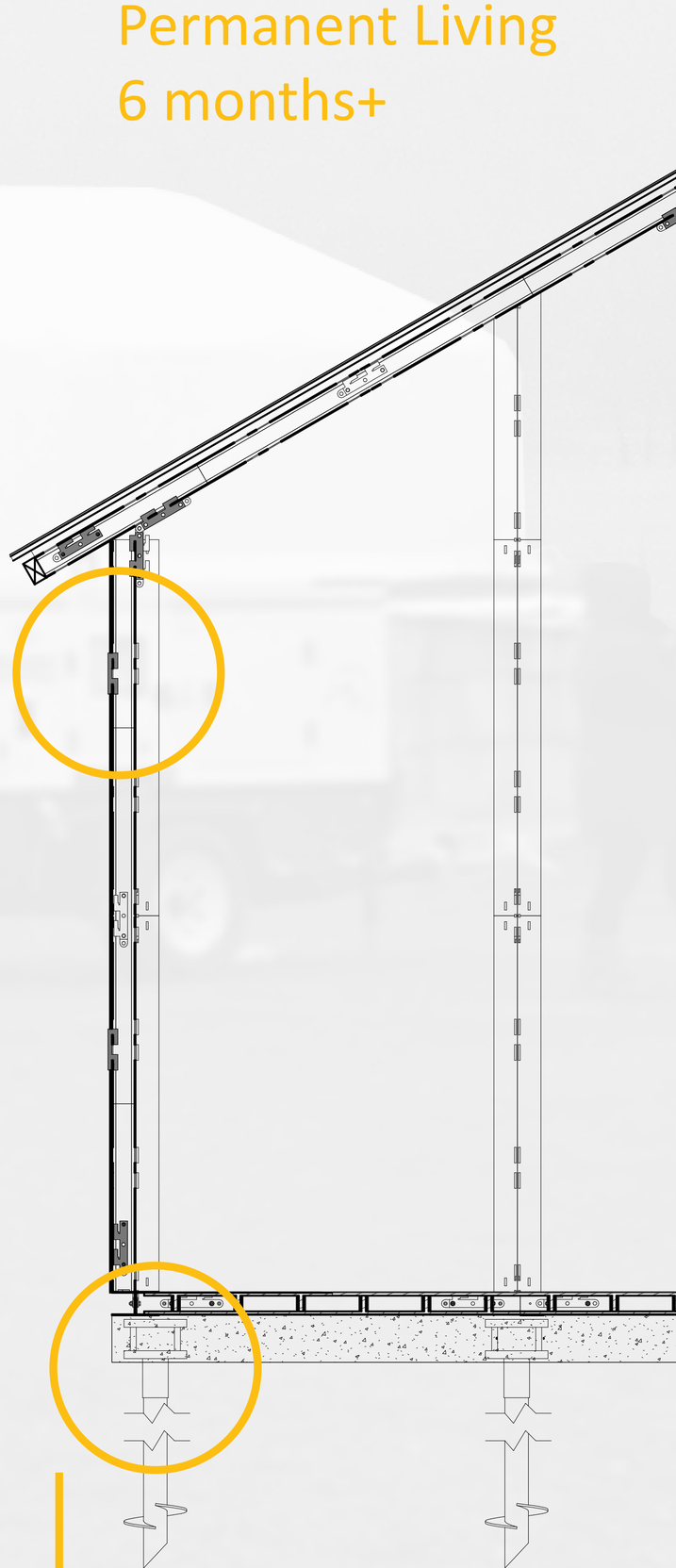
Using Kinetic Response Tectonics, Piedmont can now be better prepared and reduce vulnerability to future disasters.



Housing Configurations

The 12'x12' grid of each phase promotes a modular and easily adaptable structure. Once Kinetic Response has reached its final destination, unlimited configurations of the modular design can be achieved.

Permanent Living
6 months+



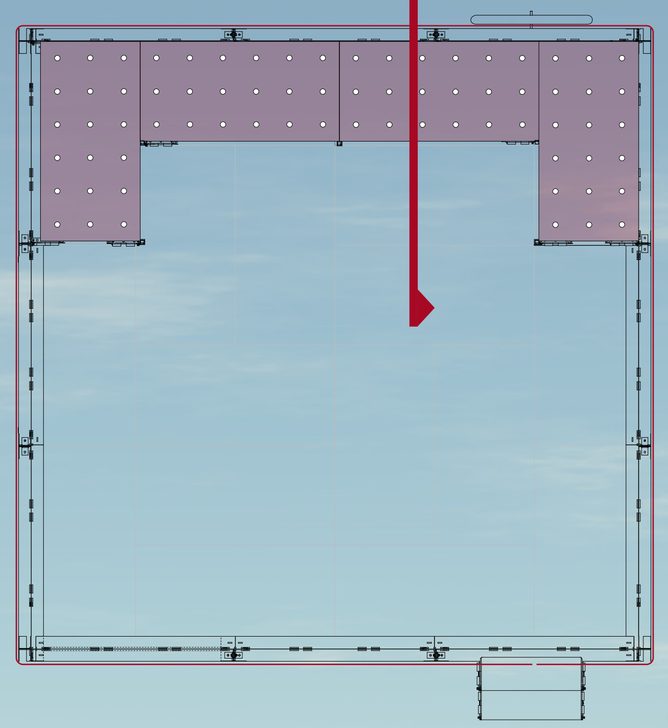
Exterior

Metal Panels have been developed to utilize the aluminum framework to support the exterior finishing. This panel system allows maximum flexibility in window placement, color, and assembly ease.

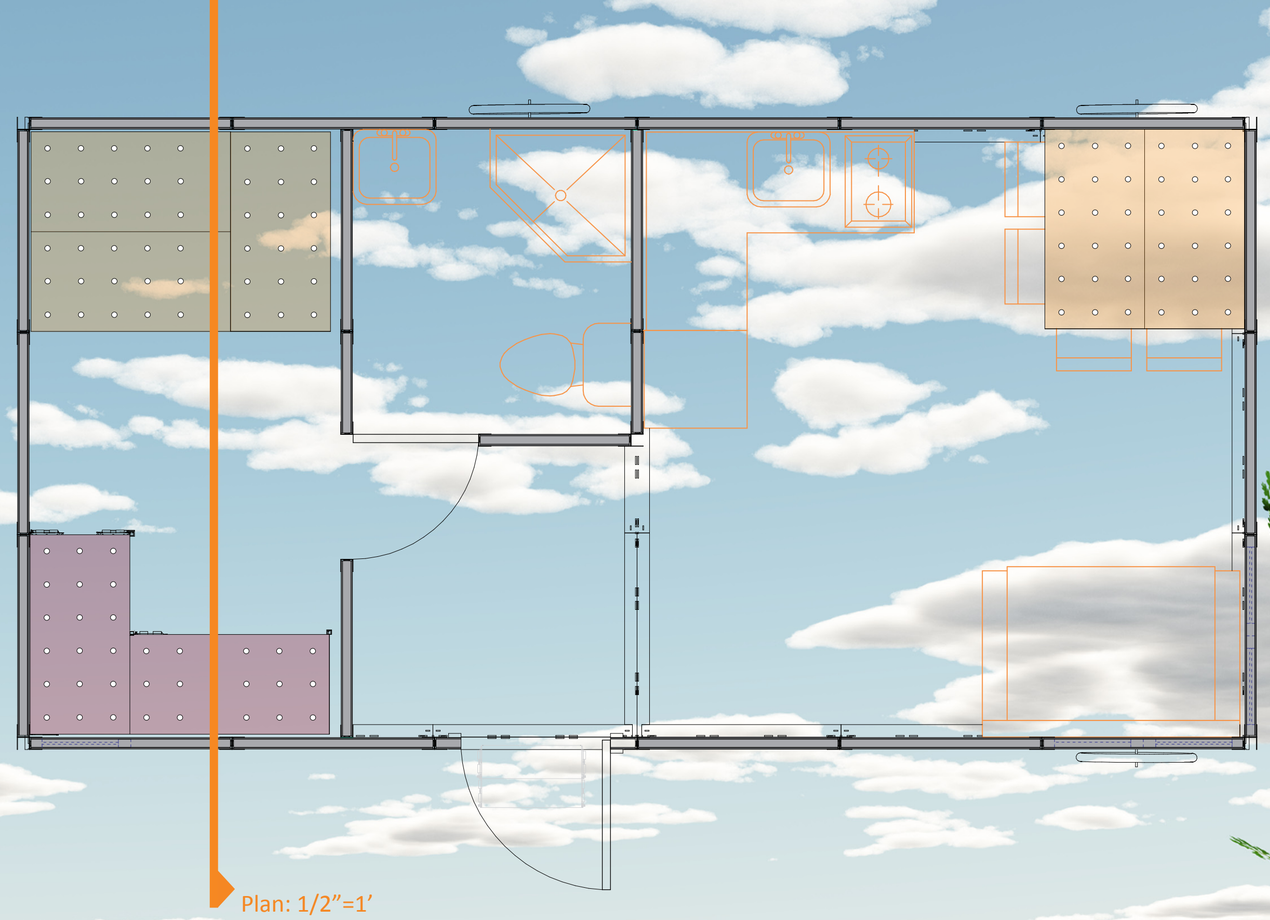
Post-Reconstruction Use:

Helical Pier Foundation

Helical Piers are the preferred foundation system for permanent living. The 6' pier can be easily driven into the ground with little framework and perform well under adverse ground conditions.



Plan: 1/2”=1’



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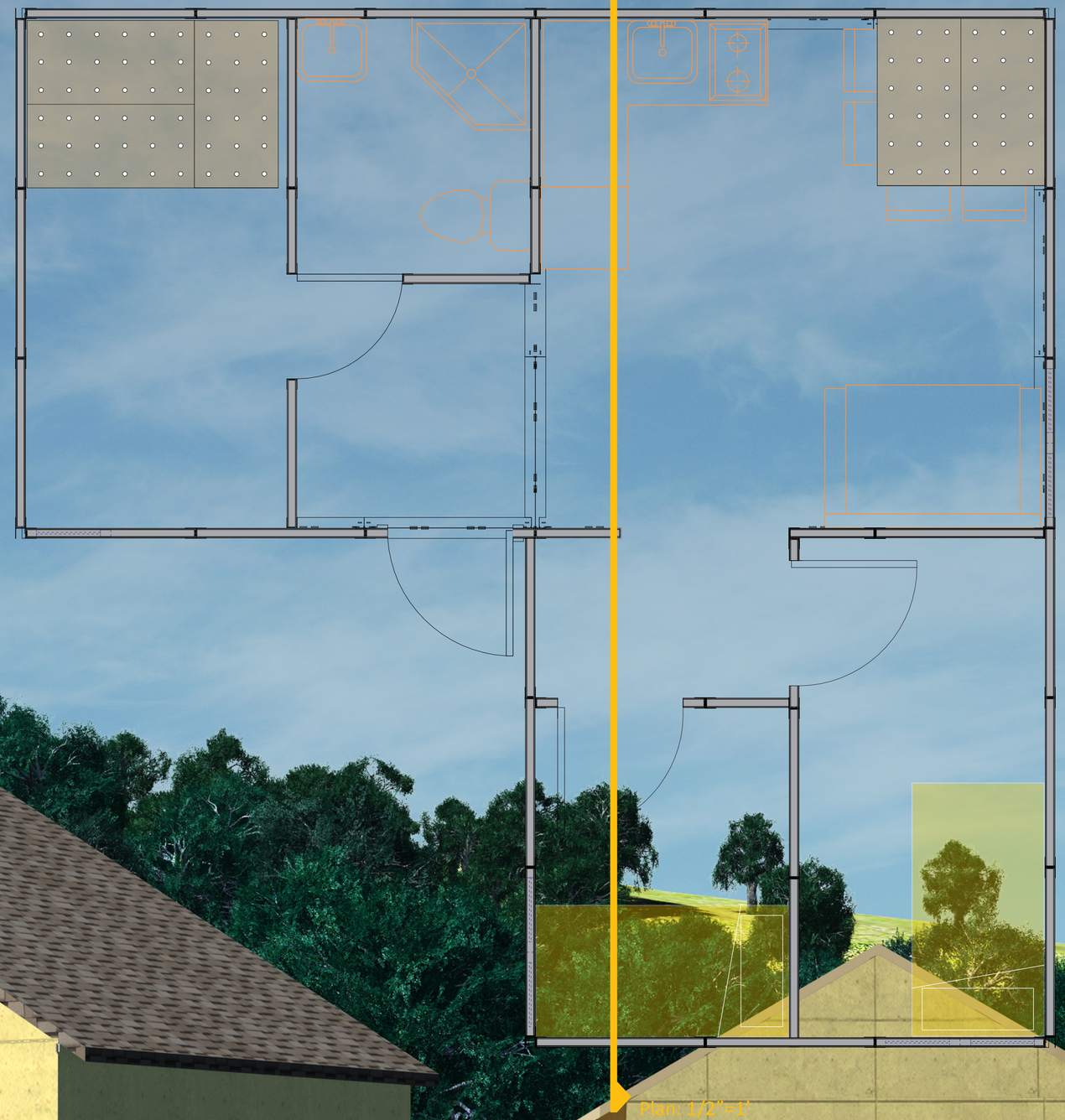

Plan: 1/2"=1'

Kathryn D. Lindmeier
Autodesk Inventor; AutoCad;
Revit; 3DS Max Design
Vue 9 xStream
Adobe Creative Suite
Google Sketchup
Thesis Advisor: Darryl Booker